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## Final Environmental Impact Statement

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# Waste Management Operations

## Idaho National Engineering Laboratory Idaho

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Responsible Official:

Energy Research & Development  
Administration

A handwritten signature of James L. Liverman is written over a horizontal line. The signature is in cursive and reads "James L. Liverman".

**James L. Liverman**  
Assistant Administrator for Environment  
and Safety

**September 1977**

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## FOREWORD

Since 1951, when the Experimental Breeder Reactor Number 1 (EBR-I) began operation, radioactive and nonradioactive wastes have been generated at the Idaho National Engineering Laboratory (INEL)[a]. Storage and disposal of all wastes generated by EBR-I and other INEL reactor and support facilities, including national defense-related facilities, have required a continuous and evolving program for waste management and for assessments of the possible impacts of that program on various facets of the environment. In addition to wastes generated onsite, some wastes from other Energy Research and Development Administration (ERDA)[b] facilities have been transported to INEL for storage. However, no commercial wastes have ever been transferred to the site.

Administration of the program for disposition of wastes at INEL is the responsibility of ERDA, with major operations performed by operating contractors. The Health Services Laboratory (HSL), an ERDA-operated and staffed facility, has prime responsibility for measuring the environmental impacts of waste management operations. This laboratory relies on assistance from the U.S. Geological Survey and the National Oceanic and Atmospheric Administration, both of which maintain onsite offices, to assist in matters involving geology and weather phenomena, respectively. In addition, since the designation of INEL as a National Environmental Research Park in 1975, a varied environmental research program has been carried out by a number of universities.

The purposes of this statement are: (1) to evaluate the environmental impact of the current and ongoing INEL waste management operations to ensure that present actions have minimal adverse environmental consequences; (2) to identify environmental consequences of the program that may not have been fully evaluated on the outset or at each stage of the waste management program; (3) to serve as a base for evaluating the potential environmental impact of future waste management programs at INEL in relation to the existing environment; and (4) to evaluate viable alternatives to determine the best methods to further mitigate environmental effects.

All facilities at INEL are described in the statement along with the waste management operations at each. Research and development activities related to waste handling, storage, and disposal are described in

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[a] Until August 1974, INEL was known as the National Reactor Testing Station (NRTS).

[b] ERDA was established by the Energy Reorganization Act of 1974 (Public Law 93-438) and was made effective January 19, 1975, by Executive Order 11834 dated January 15, 1975, (40 Fed. Reg. 2971). AEC was abolished and certain of the AEC's responsibilities, including production, basic research activities, and responsibility for the operations at INEL were transferred to ERDA.

detail. The environment in and around INEL is characterized to serve as a basis for assessment of the impacts of waste management operations on the environment. The environmental monitoring program both onsite and offsite is described; and methods of evaluating environmental impact are presented. Environmental impacts for normal and abnormal waste management conditions are assessed. Unavoidable adverse environmental effects are listed, alternatives for management systems for waste are discussed and cost-benefit analyses provided. A short section details the relationship between short-term and long-term productivity and another section deals with the relationship of waste management to land use, policies, and controls. Irreversible and irretrievable commitments of resources also are treated.

The statement covers the onsite management of wastes generated at INEL and also the onsite management of waste shipped to INEL from offsite ERDA programs. The statement does not cover the potential environmental impact from offsite-to-INEL shipping (transportation) operations. Those are covered in other environmental statements<sup>[a]</sup>. For wastes generated at INEL, the section on alternatives includes analyses of the impact on the environment that would result if any or all of the present activities at INEL were to cease.

Policies, criteria and standards employed with INEL waste management programs are discussed in Part II - Background and in Part III - Environmental Impact.

The preparation of the draft of this statement was announced in the Federal Register on August 14, 1973 (38 FR 21955). The draft statement was issued for public review and comment in June 1976 and a total of 20 formal comment letters was received. Public hearings on the draft statement were held in Idaho Falls, Idaho, on February 1, 1977, and in Boise, Idaho, on February 3, 1977. Comments on the draft provided by hearing participants and by the hearing board are included in Section X along with the formal written comments. All comments received have been considered in preparation of this final statement.

The draft statement omitted discussion of statements made to the Governor of Idaho and members of Congress by AEC relative to removal from the INEL of certain radioactive solid wastes by transfer to a final Federal repository. This omission is corrected in the final statement.

The draft statement reported environmental monitoring and other data collected through 1974. In this final statement, corresponding data for the years 1975 and 1976 have been included in Appendix E.

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[a] See response to Comment X.17.1, Section X for additional details and references to environmental statements on this subject.

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## I. SUMMARY

### A. INTRODUCTION

This environmental statement presents a discussion of the waste management operations in force at the Idaho National Engineering Laboratory (INEL). This section summarizes the major sections of the statement.

The basic objectives of the waste operations program at INEL are to manage the wastes to:

- (1) protect the health and safety of employees and the public;
- (2) protect man's environment;
- (3) contain high-level radioactive liquid wastes; and
- (4) solidify high-level radioactive liquid waste to safer, immobile forms.

All waste streams that are known or suspected to contain radioactivity are monitored prior to release to the environment. In addition, the environment is monitored to ensure that controls at the various facilities are performing adequately to prevent significant releases of radioactivity. Samples of air, soil, water, and foods produced from within the vicinity of INEL are checked routinely. These surveillance activities continually verify that the radiation doses to people at or near INEL are small and far below acceptable limits specified by state and Federal regulations.

### B. BACKGROUND

INEL, formerly the National Reactor Testing Station, was established in 1949 by the Atomic Energy Commission, the predecessor of the Energy Research and Development Administration (ERDA). INEL was established as an area where various types of nuclear reactors, support plants, and associated equipment could be built, tested, and operated with maximum safety. A total of 51 reactors and critical facilities have been built to date at INEL, 17 of which still are operable. These include reactors for the following programs: aircraft propulsion, naval propulsion, fast breeder development, light water safety tests, organic moderator and coolant development, materials testing, portable military power space development, and miscellaneous research. A decontamination and decommissioning program is underway to ensure disposal of the retired facilities and equipment in a safe manner.

Also located at INEL are the Idaho Chemical Processing Plant (ICPP) for processing spent fuel from Government-owned reactors and developing improved fuel reprocessing and waste management methods are being developed; and a radioactive waste management complex (RWMC) for burial and storage of various forms of solid radioactive waste.

Airborne radioactive effluents are discharged to the atmosphere through stacks from the reactor facilities, the ICPP and some support facilities. The annual average radioactivity released to the atmosphere during the preceding 10 years was 150,000 curies, of which 85,000 curies was krypton-85, 2,500 curies was tritium, and the remainder was primarily short-lived noble gases. Radioactivity in the air at INEL boundaries is well below concentrations listed in ERDA Manual Chapter 0524, Table 2.

Liquid effluents containing low levels of radioactivity are discharged to ponds and wells. The annual average of radioactivity released to the lithosphere during the preceding 10 years was 2,500 curies of which 600 curies was tritium. However, discharges directly to the lithosphere are being phased out.

High-level liquid radioactive wastes generated at ICPP are calcined to a solid form for safer interim storage. A total of 3,100,000 gallons of high-level waste has been processed into 48,600 cubic feet of calcine since 1963. However, a total of 2,130,000 gallons of high-level liquid waste is currently stored in stainless steel tanks contained in underground concrete vaults prior to calcination.

A number of short-term and long-term waste management alternatives are available to ERDA in the management of high-level waste at INEL. Since the calcine is a relatively leachable material, the present development is directed towards converting the existing and future calcine to a less soluble and dispersible material. While this interim storage mode has been demonstrated to be safe, alternatives for long-term disposal of solidified wastes are being developed.

Approximately 3.2 million cubic feet of solid transuranic waste (principally plutonium-239) generated at INEL and other ERDA facilities, are stored at INEL. Initially, transuranic wastes were packaged and stored below ground. However, since November 1970, newly received TRU wastes have been packaged in sealed containers, stored above ground on asphalt pads, and covered in such a manner that they are readily retrievable for at least 20 years. The storage and disposal sites are monitored routinely to ensure that the wastes are not migrating. ERDA is conducting a study to identify reasonable alternatives for long-term management of the transuranic waste stored at the RWMC. The study will identify costs and risks for each alternative and will form the technical basis for a site programmatic environmental impact statement which assesses the environmental impact of these alternatives.

Nonradioactive waste is generated at all INEL facilities and processed by techniques common to many industrial complexes. These wastes include process liquids and gases, effluents from boilers used for space heating, sanitary waste and sewage. The nonradioactive liquid and airborne effluents are monitored periodically at INEL to ensure compliance with applicable standards.

### C. ANTICIPATED BENEFITS

The primary benefit of the current INEL waste management operations program is the continued assurance of isolation of radioactive and other waste materials from man's environment. Other sites handling such wastes may benefit also from the availability of waste treatment systems developed at INEL.

### D. CHARACTERIZATION OF THE INEL ENVIRONMENT

INEL encompasses 894 square miles (571,800 acres). The site is a desert plain at an average elevation of approximately 5,000 feet above sea level. The plain extends across southern Idaho and is characterized by soil of relatively shallow depths underlain by basalt rock.

The site facilities are located well within the boundaries of INEL. The closest major population center is Idaho Falls, 30 air miles from the eastern boundary of INEL. The population living within a 50-mile radius of INEL is approximately 70,000. Land uses in the surrounding area include urban, industrial, irrigated farming, and dry land farming. In addition, a small area of INEL is used to graze sheep and cattle in the spring and fall.

The climate at INEL is arid and desert like. The prevailing weather is dry, sunny, and breezy. Annual precipitation averages 8.5 inches. Average annual temperature is 42°F with extremes of 102°F and -43°F. Relative humidity is low, with an average monthly minimum of 15% in August and 89% in December and February. Tornadoes are rare in this region, and those occurring tend to be small and cause little damage. Five funnel clouds (vortex clouds which do not reach the ground) and two tornadoes (which caused no damage) have been documented in 25 years of observation at INEL.

Located entirely on the eastern Snake River Plain, INEL adjoins mountains to the northwest that provide the northern boundary of the plain. The INEL area is underlain by a succession of Pliocene, Pleistocene, and recent basalt lava flows.

Prior to 1970, INEL was classified in Seismic Zone 2 of the Uniform Building Code. The classification was changed in 1970 to the higher risk Zone 3. No destructive quake has been recorded in the eastern part of the Snake River Plain. However, recent studies indicate the Snake River Plain itself is seismic and that the estimate of potential horizontal ground acceleration from seismic activities is as low as any area in the United States.

The site is located in a low depression; consequently, no water runs off the INEL. The water supply source for INEL is the vast body of groundwater contained in the Snake River Plain aquifer. The direction of flow of the aquifer is northeast to southwest. Depth to the regional water table beneath the INEL site varies from about 200 ft. in the northeast corner to 900 ft. in the southwest corner. The U.S. Geological Survey (USGS) monitors this groundwater continually.



The vegetation mosaic of INEL consists primarily of sagebrush, lanceleaf rabbitbrush, and a variety of grasses. Small mammals are abundant and the antelope is the predominant big game mammal. Sage grouse and pheasants are the only resident game birds. The only endangered species of birds that occasionally frequent INEL is the peregrine falcon. INEL has been designated a National Environmental Research Park where scientists from throughout the Nation can study environmental changes caused by man's activities and can develop information to assist in land use decisions.

#### E. ENVIRONMENTAL IMPACT OF OPERATIONS

The discharge of radioactivity to the atmosphere from stacks during routine operations is the most important local source of man-made radio-nuclides found in the onsite or offsite environs. These releases are monitored continually at the source and in the environs. The radioactive particulate materials released result in small calculated exposures (up to 5 mrem per year whole body) to a small number of individuals. General population exposures occur as the result of noble gases and tritium. The calculated 50-mile radius annual population dose is 1.2 man-rem, which is only 0.008% of the naturally occurring radiation background of 16,000 man-rem/year.

The maximum expected calculated dose at the laboratory boundary is 0.2 mrem per year whole body dose.\* This dose results from inhalation or submersion within the plume of noble gases, tritium, and particulate material released to the atmosphere from INEL facilities. However, this 0.2 mrem per year whole body dose at the laboratory boundary from direct exposure to airborne effluents represents a general population dose and a person could be expected to receive this dose only if he resided at the southern laboratory boundary continuously for one year. This dose is compared with other sources of existing radiation exposures in Table I-1. The dose is one of about 0.13% of the natural radiation which man receives at INEL.

Based on the average of the annual routine atmospheric releases during the last few years, an annual maximum offsite whole body dose commitment of 0.5 to 1 mrem and an annual 50-mile radius general population dose commitment of about 1-2 man-rems are projected to continue. These projected dose commitments are based on the premise that atmospheric releases to the environment will continue at approximately the same annual rate as in the recent past and that the programmatic research at INEL will remain constant.

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\*These rates are from 1976 data discussed in Appendix E. Data through 1974 is discussed in Section III.

TABLE I-1  
COMPARISON OF ANNUAL WHOLE BODY DOSES  
FROM NATURAL AND MAN-MADE SOURCES

	Whole Body Doses (mrem)
Natural radiation (external)	150
Diagnostic X-rays (average U.S. abdominal dose)	70
Natural radiation (internal)	25
Weapons testing residue	4-5
One transcontinental air flight	1-2
Nearest site boundary dose from INEL releases	0.2

An additional small environmental effect results from the routine release of liquids containing low levels of radioactivity into ponds or wells. USGS continually monitors the aquifer to determine the extent of released radionuclides. Tritium from INEL has not been detected farther than about 5 miles from the release point, which is 3.5 miles inside the nearest site boundary. Strontium has not been detected at distances greater than about 2 miles from the point of release, or about 6 miles inside the nearest site boundary. Plutonium has been detected up to only 740 feet from the disposal well and Iodine-129 has been detected up to only 6,300 feet from the well.

Routine nonradioactive releases at INEL produce at most only limited local adversities. Projections indicate that overall releases in future years will continue to decrease primarily by virtue of equipment improvements and process changes.

A postulated range of nonroutine incidents or accidents that might occur, based on present facility design and operation, would include tank leaks, process line leaks, accidental airborne releases, major facility filter failures, onsite shipment accidents, range fires, solid waste disposal site fires, and accidents due to natural forces.

Information on two accidental underground pipe leaks to the soil and one contaminated soil incident is provided in the statement. Analyses of these contamination incidents have indicated that they did not and do not present a hazard to employees or the public. An assessment of the various potential hazards which might result from hypothetical accidents at INEL shows that failure of a HEPA filter bank at the ICPP Waste Calciner Facility would be the most serious for the general public. If fire,

explosion, or other initiating events resulted in 100% release of the maximum activity from this filter bank, the conservatively calculated offsite dose commitment

The transportation of waste materials is also a potential source of accidental release of waste products at INEL. However, in the 25 years of transporting waste materials at INEL, no accidents affecting the public have occurred.

In 1969, a controversy arose over the safety of burial at INEL of transuranic-contaminated solid waste from the AEC's Rocky Flats Plant. After this controversy, the AEC planned that when a Federal repository was available, such waste would be transferred to it from INEL. Moreover, it was decided that additional such materials received at INEL would be stored in a readily retrievable mode. The plan was based on the belief that transferral to an underground repository in salt appeared to be the best method for attaining very long-term isolation of these wastes. At about this same time, a U.S. Public Health Service investigation concluded that no health and safety problems had occurred as a result of the burial of the solid wastes, and that it was not likely that radioactivity would migrate from the burial grounds if current procedures were continued.

The repository under consideration at the time of this controversy (Lyons, Kansas) was later abandoned. Presently ERDA is evaluating a location in southeastern New Mexico. This facility is expected to be available by the mid-1980's. The technical alternatives for long-term management of the transuranic solid wastes at INEL are being evaluated. A report on this subject is scheduled to be released for public review and comment late in 1977 and will be followed by an environmental impact statement. That statement, in final form, will provide the environmental input for decisions concerning the long-term management of these wastes. Because of the magnitude of the job, specific appropriations from Congress will likely be necessary for any removal efforts. In addition, exhumation of the wastes will not be without certain health and environmental risks. The environmental impact of the alternatives will be analyzed in the environmental impact statement.

#### F. UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

The unavoidable adverse effects which result as a consequence of operations and of the INEL waste management systems arise primarily from the routine radioactive and nonradioactive atmospheric releases from various facilities. The release radionuclides (primarily noble gases) result in small offsite population exposures. The unavoidable releases of nonradioactive chemical and industrial wastes produce only small adverse localized effects within the boundaries of INEL.

#### G. RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The operation of waste management systems at INEL has resulted in the long-term dedication of approximately 210 acres of the total 572,000 acres at INEL to long-term waste management operations. Plans for INEL call for its continuation as an area dedicated primarily to nuclear

energy activities. Certain small areas, therefore, will require surveillance, and thus long-term commitment.

#### H. RELATIONSHIP OF WASTE MANAGEMENT TO LAND USE, POLICIES, AND CONTROLS

A continuation of waste management practices at INEL requires the kinds of land use as described in Sections II and III of this statement. All land will continue to be managed consistently with Federal regulations to ensure the safety and well-being of the public.

#### I. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The resources considered to be irretrievably and irreversibly committed based on the INEL waste management operations criteria include: (1) land and materials containing or used for permanent disposal of solid and liquid radioactivity (nontransuranic wastes), since they are not considered to be either a short- or long-term hazard; (2) labor expended by construction and operating personnel; (3) materials (such as fuel and chemicals) that are burned, diluted, or consumed during use; (4) the continuing sociological commitment required for surveillance of existing and future waste storage and disposal sites; and (5) the sanitary land-fill.

#### J. ALTERNATIVES

Several alternatives to the current methods and systems have been identified for handling and storage of waste at INEL. The alternative of shutting down all waste systems with restoration of the site to its original condition was considered. This alternative would require deactivating all reactor, fuel reprocessing plant, and support system operations at INEL and transfer of these activities to an alternate location. Continued operation of waste handling systems with the transfer of waste offsite also was considered. This alternative would require the same commitment of lands and waste handling facilities at another location with the added risks and costs associated with transporting waste from INEL to the alternate location.

Finally, a number of systems for additional treatment, filtration, or holdup for both radioactive and nonradioactive waste streams were considered. In general, these systems are based upon advanced but state-of-the-art engineered systems. The extent to which they will be applied involves decisions based on environmental as well as economic and social considerations.

#### K. COST-BENEFIT ANALYSIS

The cost-benefit of various facets of the INEL waste management operations program is presented. It is concluded that the technical benefits obtained from operating INEL waste management systems justify the environmental impact identified in this statement. Continued operation of these facilities is not expected to increase the environmental impact. The future impact will be lowered as proposed improvements, based on technological alternatives to existing systems, are made throughout the waste management systems of INEL.